Coherent ρ^0 Production with Nuclear Excitation

Spencer Klein, Falk Meissner, Joakim Nystrand, Vladimir Morozov, Akio Ogawa[*], *Janet Seger*[†], *Jim Thomas, Pablo Yepes*[‡] *and the STAR Collaboration*

Photon-pomeron fusion produces ρ^0 copiously in peripheral collisions of heavy nuclei. At $\sqrt{S_{NN}}$ = 130 GeV gold on gold collisions, ρ^0 most production occurs at impact parameters b = 20 to 80 fermi[1]. In this b range, the two nuclei may be mutually excited by exchanging one or more virtual photons. The excited nuclei decay by neutron emission.

The cross section for ρ production with mutual excitation should factorize into the b-dependent mutual excitation probability times the b-dependent probability of ρ^0 production[2]. The kinematics of vector meson production is independent of the mutual excitation, and coherent vector meson production occurs, with the ρ^0 transverse momentum, $p_t < 2\hbar/R_A$.

This reaction was studied using about 400,000 minimum bias triggers collected during the summer, 2000 run[3]. This trigger requires one or more neutrons hitting each zero degree calorimeter mounted downstream of the collision region.

Events with exactly 2 tracks forming a primary vertex were selected. The resulting p_T spectrum is shown in Fig. 1a. The like-sign pairs are distributed like the phase space, disappearing as p_t decreases, while the charge zero combinations show a large peak at $p_T < 100$ MeV/c. Figure 1b shows the mass spectrum (assuming the $\pi\pi$ hypothesis) for the pairs with $p_T < 100$ MeV/c. A clear peak is visible at the ρ^0 mass.

References

[1] S. Klein and J. Nystrand, Phys. Rev. **C60**, 014903 (1999).

[2] K. Hencken, D. Trautmann and G. Baur, Z. Phys. C**68**, 473 (1995).

[3] F. Meissner and the STAR Collaboration, "Ultra-peripheral collisions," poster presented at Quark Matter 2001.

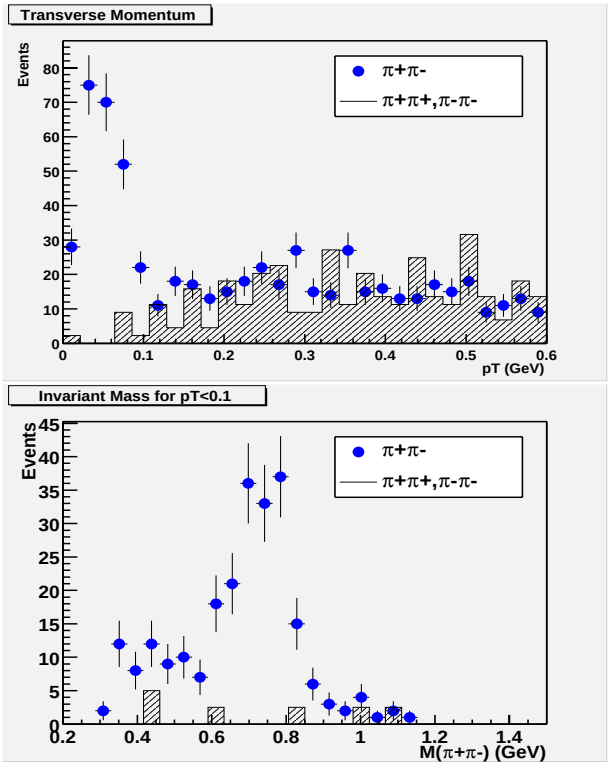

Figure 1: (a) The p_T distribution of all minimum bias 2-track events The points are oppositely charged pairs, while the hatched region is for like-sign pairs. (b) The invariant mass distribution (assuming $\pi\pi$ pairs) for pairs with $p_T < 0.1$ GeV/c.

[*]Penn. State. Univ, University Park, PA.
[†]Creighton Univ., Omaha, NE.
[‡]Rice Univ., Houston, TX.